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CAMPUS EXPLORER: FACILITATING STUDENT COMMUNITIES THROUGH GAMING

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ABSTRACT

University students are often highly focused on their current lectures and imminent exams and thus neglect to interact with students across departments and to engage in campus life. To facilitate a more closely-knit community of university students, we evaluate a set of suitable core game mechanics, social features, and reward systems to motivate students to explore their university and to meet other students. Our prototype mobile application implements a location-based approach and includes game mechanics such as building check-ins, meeting other students, campus expeditions, and campus events. We evaluate the potential of our approach using both qualitative and quantitative data collected during an initial playtesting phase. Our analysis has shown that our location-based mechanics and a focus on social features were well received by students. Players engaged in exploring the campus and see potential in location-sharing and future collaboration features.

KEYWORDS

Gamification, Location-based, Game Design, Social, Community Building

1. INTRODUCTION

Despite extracurricular activities offered by most universities, interacting with students across departments and engaging in campus life can be challenging for students. Between lectures, projects, exercises, and exams, time to meet new people and to explore the campus is often scarce. On larger campuses, many students visit lectures affiliated with a specific department. Such lectures are typically held at only a small subset of all university buildings. The hurdle for cross-department interactions can, therefore, be high. To approach these problems, we evaluate solutions based on *gamification* and *location-based mobile gaming*. In a university context, gamification is often used as a tool to motivate learning behavior and for educational purposes (Seaborn and Fels, 2015). However, the objectives of our gamified experience targeted at university students are to gamify campus life and community building. Moreover, we intend to spark a feeling of belonging to the university.

For successful gamification, game mechanics need to be chosen with care. Deterding (2012) argues that implementing simple components of complex modern games cannot only fail to engage players but actually damage their interest. Successful gamification requires a deep understanding of the users and their motivators. This allows for utilizing and amplifying their intrinsic motivation for a certain task, rather than trying to force behavior for which the users have no motivation.

Based on our objectives, we have identified a set of tasks for which to motivate students. Those tasks are exploration and discovery, communication and participation in campus activities. In order to determine whether those tasks are interesting to players and what game mechanics could be used to amplify that interest, we have implemented a concept for a mobile game called *Campus Explorer*. As a pilot implementation, it focuses on the design and evaluation of a location-based base mechanic allowing check-ins to locations in the real world and on creating a feeling of belonging to the university through exploration, communication, and location-sharing features. It lays the groundwork for future work in this area to further explore this approach to gamify community building and collaborative tasks to motivate students to meet in the real world.

We carefully selected game mechanics and reward systems found in social media platforms and existing mobile games to evaluate their suitability as motivators for each task. The mechanics are implemented as points of interest (POIs) displayed on a virtual map (Figure 1), which the player can explore by moving in the real world. Real-life location changes are adopted by an avatar representing the player. The game features quick and simple gameplay. Thus, it may be played before and after lectures, while commuting between university buildings or during breaks. We implemented our prototype as a mobile game for the Android and iOS platforms using the Unity[1] game engine in the front-end and Amazon Web Services (AWS)[2] in the back-end. We evaluated Campus Explorer in a playtesting session of four weeks testing the location-based concept and the selected game mechanics with respect to our objectives.

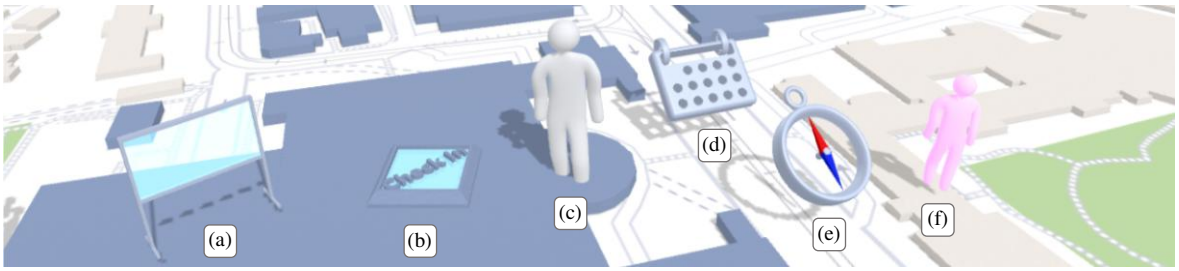


Figure 1. Variations of the point of interest base-mechanic: (a) blackboards, (b) building check-ins, (c) the player's avatar, (d) event check-ins, (e) expedition check-ins and (f) player check-ins displayed on the game map

2. RELATED WORK

Deterding (2012) created an achievement system for students in interactive games and media. Students could receive collectible cards for playful or creative interactions with staff and faculty as such interactions have proven to increase student retention rates. Moreover, an achievement was given to everyone playing the game, if more than 90% of the freshmen would pass the introductory programming class. In response, juniors and seniors organized study session for the freshman, and instead of the usual 85%, the passing rate was at 91%.

For Campus Explorer we decided to focus more on interactions between students and on exploring the campus, rather than interactions with staff and academic achievements, thus gamifying extracurricular activities and campus life. We tried to adhere to the findings of Deterding creating challenges and mechanics which would engage students in fun and interesting tasks and amplify their motivation to take part in campus life.

Fitz-Walter et al. (2012) implemented Orientation Passport, a gamified application pursuing similar objectives to ours. The authors' main goals include introducing students to the campus, encouraging exploration and participation in events as well as socializing among students and simplifying the transition from school to the university environment.

Whereas Campus Explorer is meant to enrich the student experience throughout the whole semester, Orientation Passport is specifically targeted at new students in their first few weeks at the university. Another significant difference in their approach is Orientation Passport not being designed as a game first. Instead, their application offers a number of functionalities helpful for students attending university orientation. The achievement system and game elements were later introduced to create a more motivating and fun experience.

The results achieved with Orientation Passport are promising, and the gamification of Orientation Passport was well received by students. The location-based functionality offered by utilizing QR codes was favored by most students over other game elements and the interactive map added to the application was considered among the most useful features. These findings show that the game mechanics we selected for Campus Explorer, which are mainly based on exploring an in-game world map, may in fact be well received by students.

[1] https://unity3d.com/
[2] https://aws.amazon.com/

3. GAME DESIGN

We designed Campus Explorer as a mobile social and exploration game targeting smartphones and tablets (Android and iOS). Running on mobile devices, the game can easily be played in-between lectures or while exploring the campus. Moreover, this approach allows us to use the built-in GPS of such devices to implement a location-based approach. Utilizing the real-life location of the player enables us to show players interesting locations on the campus in close proximity and to verify visits using our POI mechanics (Section 3.2).

Location-based social media applications specifically targeted at students have proven the potential of location-based services in a university context. Examples include Yik Yak, once valued at $400 million (Statt, 2017), and Jodel[3] with 1.5 million active users and 5 million messages being posted each day (Kreuter, 2017). Campus Explorer evaluates similar social functionality implemented as blackboards (Section 3.2).

The core concept of Campus Explorer relies on three basic steps:

1. **Exploring the map:** The players explore the game map by moving in the real world.
2. **Visiting locations:** Tasks and challenges based on our POI system.
3. **Receiving rewards:** For visiting POIs, a player is rewarded with points and achievements.

3.1 Player Motivation

According to Aparicio et al. (2012), successful gamification requires the identification of intrinsic motivators or objectives interesting to people before the appropriate mechanics can be determined. We specifically selected our game mechanics to cater to the four player types as defined in Bartle's taxonomy (Bartle, 1996). Bartle identifies four groups of players, each responding to different motivators: Achievers, Explorers, Socializers, and Killers.

While the reward systems discussed in Section 3.3 offer mechanics designed for achievers and killers, our building and expedition check-ins offer exploration and our blackboards, event and player check-ins are meant to intrigue socializers.

To motivate players regardless of their player type, Csikszentmihalyi (1975) argues that players need to be challenged according to their skills. Thus, as a player's skills increase while playing the game, challenges need to increase as well. For this reason, we offer increasingly more complex variants of our POI system, which are unlocked during the course of our game. When users start the game for the first time, they are confronted with only two simple POI variants: Building check-ins to acquire points and blackboards to communicate with other players. The remaining mechanics unlock as the player progresses.

3.2 Points of Interest

The mechanics and features we evaluate with Campus Explorer are based on variations of a POI-based core-mechanic. This concept is similar to Pokémon Go[4], which has previously shown the potential to motivate students to walk to POIs in the real world (Barkley et al., 2017). As shown in Figure 2, our POI system allows us to place tasks, events, and locations to explore as well as other students on a map representing a player's actual surroundings. Each POI provides some functionality to confirm a visit to the location. For each visit, the player is rewarded according to Section 3.3 and the POI is added to the player's collection of completed activities.

Building Check-ins. As the simplest variation of our POI system, building check-ins allow players to check into university buildings by the press of a button displayed on the game map. The building check-in is a very simple task on purpose. We intend the feature to encourage players to open the application whenever they are on campus to receive some quickly earned points and to motivate them to explore and discover buildings. For this reason, we allow daily check-ins for each building. Thus, the feature should serve as a catalyst for players to try out the more complex POIs of our application.

Blackboards. Campus Explorer features virtual blackboards that allow players to anonymously communicate with each other in a location-based manner. Our virtual blackboards are inspired by the idea of actual physical blackboards which are usually bound to a certain location and are sometimes used by students

[3] https://www.jodel-app.com/
[4] https://www.pokemongo.com/

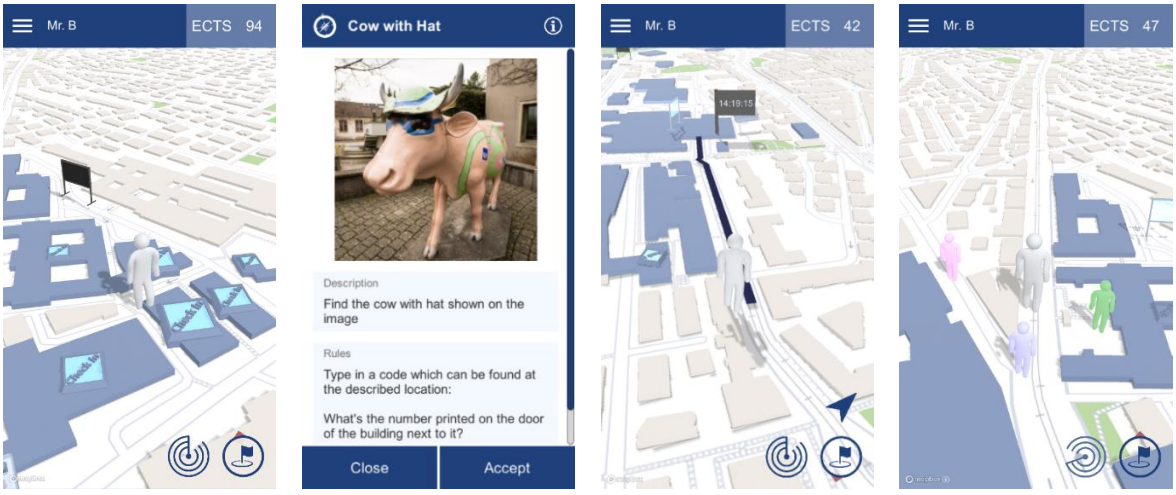
to leave their own anonymous messages and drawings. A visit is performed by posting a message on the board. Due to our blackboards allowing an unlimited amount of posts, we have decided against rewarding points for each visit and thus removed a major extrinsic motivator for this task. Instead, we allow the players to upvote and downvote messages and sort the messages based on their score. We intend postings well-liked by other players to be rewarded through a higher placement on the list of top messages as it has been done previously in applications such as Yik Yak and Jodel.

Expedition Check-ins. Since the building check-ins may provide little challenge for advanced players, we introduce expedition check-ins as a more complex exploration-based task. They require a player to find a specific location on the campus based on a description and optionally an image. Due to a potentially large number of different expeditions, they can be accepted at expedition hubs in a similar fashion to accepting a quest in a role-playing game. This allows players to select an expedition they deem interesting and to solve it when it is most convenient for them. Thus, an expedition comprises two types of POIs: A hub to accept the expedition and an expedition goal to confirm the check-in.

Event Check-ins. Similar to the approach chosen for the expedition check-ins, players can choose from different events accessible through an event hub and confirm a visit at the event destination. However, due to the nature of events, there is an added time constraint. The exact location of the event is communicated to the player through the description of the event and a navigation line displayed on the map optionally guides the player to the event location. To confirm the check-in, an additional code can be defined, which could be communicated by the event organizer during the event.

Player Check-ins. Player check-ins are POIs that are created from player data and allow for location-sharing among players. They are represented on the map by color-coded avatars. Once checked into, a player can schedule a meeting with the other player to receive additional points. To confirm that two players have indeed met, they each input a code that is displayed on the other player's phone.

Due to potential privacy concerns, player check-ins are a voluntary feature. A player check-in is placed at the player's current location only if they press a radar button displayed at the bottom of the screen. This POI will be available to other players for a predefined number of hours. In exchange for activating the radar, the player check-ins based on the other players' avatars are made visible and allow for check-in. Otherwise, no avatars are shown apart from the player's own avatar.



(a) (b) (c) (d)

Figure 2. (a) Check-in buttons placed on the map allow check-ins to buildings, (b) the description of an expedition check-in enables players to find locations at the university, (c) a navigation line guides the player to an event location, (d) location-sharing functionality allows finding other players on the map

3.3 Reward Systems

Schell (2014) states that the most important rule of any game is its goal or its sequence of goals. Goals should be concrete, achievable and rewarding. We try to meet these requirements by focusing on one basic game mechanic, our POI system, which allows progressively more challenging variations, and on well-established reward systems such as points, leaderboards, and achievements.

Points are the core of our reward system. Campus Explorer rewards points for checking into POIs and for unlocking achievements. The number of awarded points depends on the complexity of the task. For instance, checking into a building is rewarded with a minimal number of points, whereas expeditions reward the highest number. Based on the number of points collected, the player is ranked on a leaderboard. This allows players of the killer player type in Bartle's taxonomy to compete and impress their peers. For achievers, it sets the goal to reach high rankings.

In addition to receiving points for the goals set by the POI mechanic, an achievement system provides extrinsic motivation to complete specific meta-goals, which might intrigue the achiever and the explorer player types. We created achievements for reaching certain numbers of check-ins (such as an "explorer" achievement for checking into multiple buildings), for checking into players from multiple different university departments, and for acquiring certain amounts of points.

3.4 Tutorial

To teach players our game mechanics and clearly define goals for the player to reach, we provide a comprehensive tutorial mode and help buttons available in the header bar of most panels. The tutorial starts automatically when playing the game for the first time and continues automatically after unlocking each feature. For the duration of the tutorial, the player's avatar is placed on the campus close to the POIs relevant to the tutorial. Thus, it is playable from outside of the campus and does not depend on the player's current location.

4. IMPLEMENTATION

We developed Campus Explorer as a cross-platform mobile Unity application for Android and iOS. In the back-end, we employ a NoSQL database provided by AWS and utilize serverless lambda functions to operate on the data. Storing all player and POI data in the NoSQL database enables us to add new tasks and challenges without changing the application binaries, to analyze and visualize player behavior, to adjust the game rules to better balance the game, and to add new achievements when some players have progressed further than we have originally planned. As Campus Explorer is a location-based application, we use the services provided by Mapbox[5] to display map data in the Unity game client.

5. EVALUATION

We evaluated our first prototype implementation in the form of a playtest at the campuses of two local universities. We collected both quantitative data stored by our game and qualitative data based on a survey.

5.1 Test Setup

We released our game in the beta programs of the official distribution platforms of our supported operating systems Android and iOS. This allowed our selected participants to download the game to their own devices and to play it on their own terms and in multiple sessions throughout a given test period. Participants were given a basic description of the game, as it would be found in the application stores native to each supported OS. During the playtest, the participant’s goal was to unlock as many features of the app as time permitted and to rank as high as possible on the leaderboard. The playtesting session lasted four weeks, and we continuously added participants.

To realistically evaluate our game, we created more than 200 POIs at the two campuses and at additional locations convenient for our participants. To create interesting expeditions, we scouted the campus areas our participants would be most likely to visit. We photographed attractions, art pieces, statues, and buildings as visual aids and as additional motivation for the participants to find the locations.

[5] https://www.mapbox.com/

As our evaluations happened on a small scale and within a short time frame, we did not yet have the opportunity to work together with the universities to include real-life events in our prototype. This is an important constraint to consider with respect to the results of our playtest. Instead, we created event check-ins located at canteens, allowing check-ins during lunchtime, and at train stations, allowing check-ins each morning and evening. Additionally, we created two events at the university sports center representing real sports lessons.

5.2 Playtest Results

During our playtest, 49 individual players started the Campus Explorer application at least once. We received 29 answers to our survey, which we sent to each participant four days before the end of the playtest. Of the 29 participants responding to our survey, 14% were female and 86% were male. 90% of the participants were students with a background in computer science or technology. 41% did not attend any lectures during the playtesting phase and were therefore rarely on campus. This is due to many of the participating students working on projects, such as their master's thesis. Due to a disproportionately large number of our participants being male and visiting only a few or no lectures, they represent only a subgroup of students we are targeting with Campus Explorer. Further testing with students of different demographics could gain valuable additional insights in the future.

5.2.1 Player Activities and Performance

Out of 49 players, 96% checked into buildings and accumulated a total of 784 building check-ins. In comparison, other POI variations were only used by between 22% and 31% and the number of accumulated check-ins is considerably lower. However, while only 31% of the players posted messages on the blackboard, 92% looked at the messages posted on the blackboards a total of 339 times.

Our numbers show that most testers played the first lecture of the tutorial introducing them to the building check-in. 96% of the players checked into the building that can be checked into during the tutorial phase. Many players decided not to continue playing shortly after the tutorial with half the players (49%) starting the game less than five times during the test phase. This might explain lower numbers for checking into other POI types than the ones initially unlocked (visualized in Figure 3) and for receiving at least one achievement (55% of the players unlocked achievements leading to a total of 116 achievements). This retention rate might be partially due to many testers not attending lectures during the playtesting phase and thus rarely visiting the campus.

(a) (b) (c)

Figure 3. Heatmaps visualizing (a) 784 building check-ins, (b) 91 expedition check-ins, (c) 46 event check-ins

5.2.2 Survey Results

The first part of our survey contained questions about games for students in general, before focusing specifically on our implementation. For each of these questions, the participants could select exactly one given option or suggest their own answer.

Asked about the genre that would fit a student-oriented mobile game the most, 38% of the playtesters would prefer a social or party game and 34% chose location-based exploration. In addition, more than half of the testers (55%) favored social features as the main focus such a game should have. Gaming features (17%), competition (14%) and exploration (7%) had priority for a minority of the testers. When asked specifically about whether the location-based mechanic works as the base for a game for students, only 10% of the

participants would have preferred a different base mechanic. Thus, our location-based game with social features seems to be in line with our tester's preferences towards a game for students.

In the second part of the survey, we focused specifically on our prototype. First, we asked our playtesters what they thought of the mix of gaming, social and exploration features in Campus Explorer. A majority of 59% of the testers selected the option stating that the mix enriches the experience. 41% were of the opinion that there should be a clearer focus. None of the participants stated that Campus Explorer should be a game only or not a game at all. While a future prototype could focus more on a specific mechanic, overall, offering a mix of features satisfying different styles of playing seems to be a promising solution.

Despite the numerous features and variations of POIs, most participants found the game to be easy to understand with an average rating of 3.9 on a scale from 1 ("complicated") to 5 ("easy to understand").

For different types of features, we asked the playtesters whether they would like to see more of them, if the current implementation offers enough of those features or if there should be less of them. The results are shown in Figure 4 and suggest that while the amount of exploration and social features in our prototype is satisfying to a majority of testers, future iterations might profit from more gaming and collaborative features.

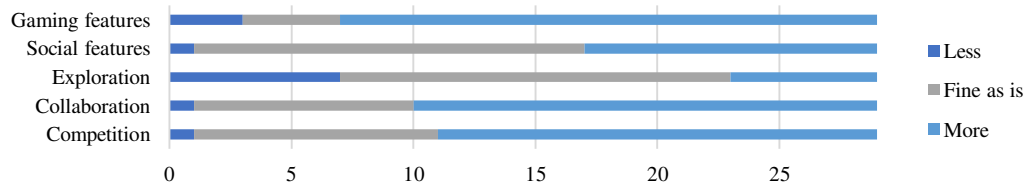


Figure 4. Feature categories rated by whether there should be more or less of them

For each of our five POI variations, we asked participants to rate them in their current state on a scale from 1 ("didn't like") to 5 ("loved") and to rate their future potential on the same scale from 1 ("should be removed") to 5 ("has a lot of potential"). For simplicity, we average the rating for each functionality in Figure 5. The ratings suggest that all of the aforementioned features were generally liked more than they were disliked, yet there was also no feature that was outstandingly well received by players. This is a result we expected for a first prototype as no previous balancing or polishing based on actual player feedback had been performed. We can detect a tendency for features with lower ratings based on their current state to be attributed with a higher potential and vice versa. Based on the results, player check-ins would benefit the most from further polishing. This feature could be extended to allow to manage friends lists, to facilitate communication and to enable collaboration between nearby players for future collaborative tasks.

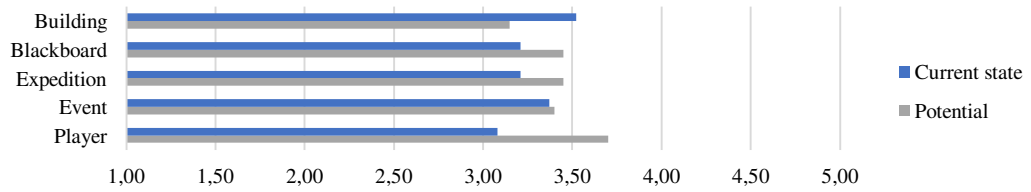


Figure 5. The average rating of the current state and potential of each POI variant on a scale from 1 to 5

We asked to rate a number of functionalities in our game based on how motivating they are. The average ratings on a scale from 1 ("demotivating") to 5 ("very motivating") are shown in Figure 6. Despite a majority of players answering in favor of social features in the first part of the survey, the social aspect of our prototype was not especially motivating for players. Points as an extrinsic motivator were rated highest with an average of 4.0. This indicates a potential for future work to redesign the social and exploration features to be more motivating on their own for the game to rely less on extrinsic motivators such as points, achievements, and leaderboards.

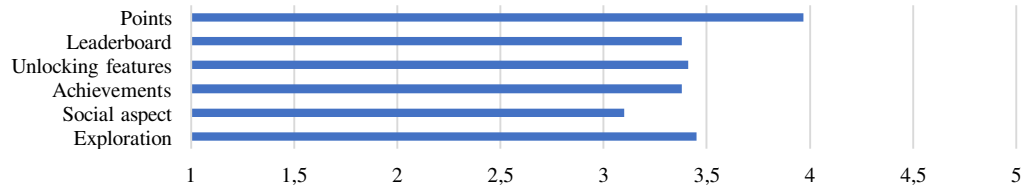


Figure 6. The average motivation rating of the features in Campus Explorer from 1 to 5

When asked if any feature led the playtesters to meet other players, only 7% answered positively. However, they all reported to having previously known the players they met. We hope to facilitate more player meetings in the future with real-life events represented in the game and with the addition of collaborative gameplay elements.

Creating a feeling of belonging is an important goal we tried to achieve with Campus Explorer. 52% of the playtesters believe that the game could spark such feelings if there were more players and 17% already felt closer to their university using our current prototype. 14% of the playtesters reported that the game provoked no such feelings. Those are very promising results as they suggest that the current prototype of Campus Explorer could already spark a feeling of belonging if it was widely deployed.

6. CONCLUSION

We designed and implemented a mobile location-based game, Campus Explorer, with the intention to gamify campus life, to facilitate community building, and for students to develop a feeling of belonging to their university. Five POI-based game mechanics, that is, building check-ins, blackboards, expedition check-ins, event check-ins, and player check-ins, contribute to a rich and promising gaming experience.

In a playtesting session of four weeks with 49 active players, we evaluated the game mechanics in terms of their suitability to provide motivation for students to explore and to discover, to communicate, and to participate in campus activities. Asked about games targeted at students, a vast majority of our playtesters are in favor of the location-based approach and appreciate a strong focus on social features. The mix of features made possible by our POI system was generally well received. The number of exploration features was satisfying to most players and building check-ins were performed at particularly high rates. Most players agreed that our approach has the potential to spark a feeling of belonging to the university if more students played the game.

For future work, players see potential in the location-sharing feature in the form of player check-ins and would appreciate more gaming and collaborative features. To facilitate community building, the player check-ins could be used to form groups of players that collaborate and compete with each other. Furthermore, our POI system could be varied to incorporate puzzles, quiz-questions, and collaborative mini-games to complete check-ins.

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